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PRELIMINARY GUIDE TO RESEEDING PINYON-JUNIPER LANDS OF WESTERN COLORADO

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F O R E W O R D

Range reseeding can increase by many times the amount of grass on 500,000 acres of depleted pinyon-juniper range in western Colorado. Such an increase in grass would help stabilize the livestock industry by increasing the supply of spring forage. It would also aid in reducing soil erosion.

This publication gives some preliminary guides to help livestock men and range administrators do a better job of seeding these lands. The basic principles and guides which make for successful reseeding include the following:

1. Select productive sites where success is likely.

2. Choose areas where forage or soil protection is needed.

3. Kill competing vegetation and prepare a good seedbed.

4. Choose forage plants which will yield the greatest returns.

5. Seed at the proper season.

6. Get the seed in the ground at the proper depth and rate.

7. Protect the young plants until they can withstand grazing.

8. Maintain the reseeded stand by proper grazing management.

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WHY RESEED

Pinyon-juniper[1/] lands in western Colorado are producing only a fraction of the forage they should be producing. At present the palatable vegetation on an average acre would hardly maintain a cow for a single day. This low productivity might be expected on some of the steep rocky slopes with shallow or alkaline soils, but many relatively level mesas and scattered sagebrush parks with good soils are also nearly devoid of palatable grasses and weeds.

Most of the pinyon-juniper type is used by domestic livestock and big game. Sheep and cattle make some use of the type in fall and winter, but for livestock it is primarily early spring range. Deer utilize the limited forage on pinyon-juniper lands very heavily in winter, and denuded and eroded areas are especially evident in their concentration areas--such as Kannah Creek, Douglas Creek, and the Book Cliff region near Grand Junction; the Winter Mesa and Blue Mesa areas adjacent to the Uncompahgre National Forest; and areas near Rifle and Eagle. Some deer remain in the type throughout the year, although the majority of them migrate to higher ranges in the summer.

Nearly all of the accessible areas have been used far in excess of their ability to produce forage, and often early in the season before the range is ready for grazing. Throughout the entire Western Slope the livestock industry faces a serious shortage of spring range. This lack of adequate forage often results in over-use of all ranges and too early use of summer ranges.

1/ Scientific and common names of native plants appear on page 16. Pinyon pine is mostly Pinus edulis. Juniper is mostly Juniperus utahensis with some J. monosperma and J. scopulorum.

A recent survey of the pinyon-juniper type in western Colorado showed:

1. Over 80 percent of the type is in poor or very poor condition.
2. Plant cover (except trees) averaged only 3 percent.
3. Herbage production of grasses and weeds averaged 70 pounds per acre.

Pinyon-juniper lands contribute more silt to the Colorado River than any other forage type in western Colorado. Sheet erosion is severe throughout the type. Tests made in 1948-1949 with the Rocky Mountain infiltrometer[2/] indicated that soil erosion rates were 2½ times higher on grazed ranges than on protected ranges, and that litter and vegetation cover had a marked influence in reducing erosion rates. Erosion rates of 1 to 9 tons of soil per acre for every inch of water which ran off the surface were common on severely depleted pinyon-juniper ranges.

Many corrective measures are needed to alleviate the problems and ills of the pinyon-juniper lands. It is estimated that proper grazing management of both domestic livestock and big game must be relied on for improving 90 percent of the land. Artificial reseeding may play an important role in improving the other 10 percent, amounting to one-half million acres. Reseeding some of the more productive sites has resulted in manyfold increases in grass (figs. 1 and 2). Reseeding not only increases the amount of forage but supplies forage in early spring when it is most needed. Grass also produces many fine roots that hold the soil in place and reduce siltation of our streams, reservoirs, and irrigation systems.

DESCRIPTION OF PINYON-JUNIPER LANDS

Pinyon-juniper woodlands cover about one-fifth of western Colorado and occur almost entirely on soils derived from sandstones or shales. The estimated 5 million acres in the type may be divided into the lower pinyon-juniper zone and the upper pinyon-juniper zone.

The lower zone ranges from 6,000 to 7,000 feet in elevation and has an annual precipitation of from 10 to 13 inches. Areas representing this zone are found in the lower drainages of nearly all western Colorado rivers--San Miguel, Dolores, San Juan, Animas, Uncompahgre, Gunnison, Colorado, Yampa, and Piceance and Yellow Creeks. An example of the lower zone is shown in fig. 3. The lower edge of this zone commonly blends into the desert shrub type. There are some sagebrush parks that usually indicate good soils and sites but for the most part this lower zone is hot and dry with shallow soils, sparse vegetation, and many raw eroding slopes. On sandy soils, the scattered native understory plants commonly found are galleta, cheatgrass, Indian ricegrass, Fendler three-awn, Russian thistle, tumbling mustard, phlox, prickly pear, broom snakeweed, and bitterbrush. The shale soils support even less understory vegetation and the prominent native plants are shadscale, western wheatgrass, and Colorado wild-rye. Results from experimental seedings in this lower zone have been poor thus far, although only a few methods and times of seeding have been tested. Reseeding in the lower zone will be difficult and should not be undertaken on a large scale until better seeding methods have been determined.

2/ See 1949 Annual Report for Rocky Mountain Forest and Range Experiment Station.

Figure 1.--A typical pinyon-juniper site southwest of Montrose, Colorado, in need of reseeding. Grass production here is less than 50 pounds per acre (air-dry weight).

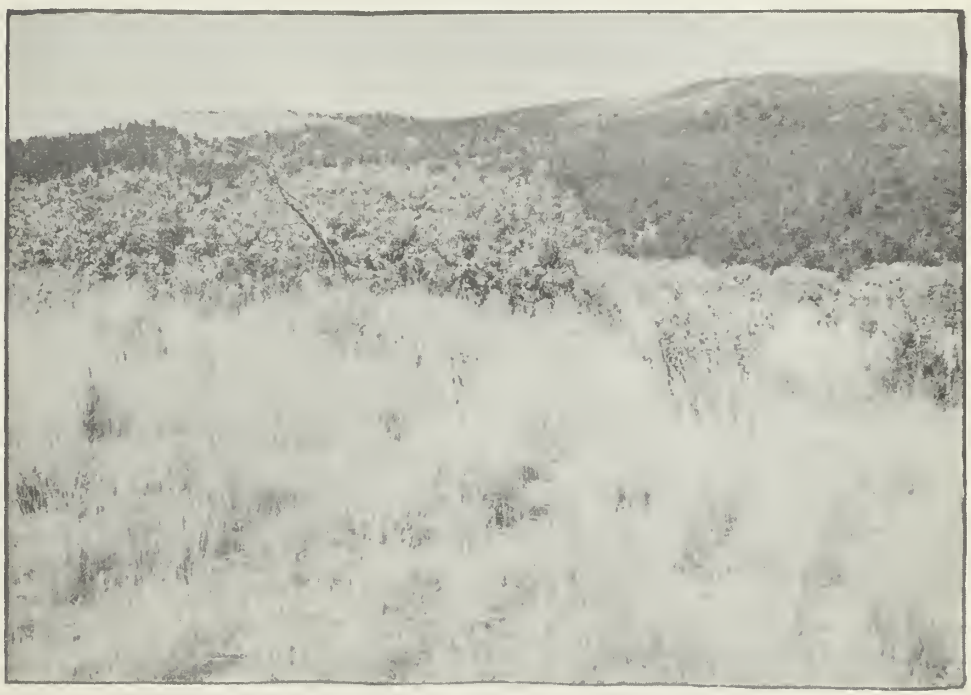

Figure 2.--A good stand of crested wheatgrass in the upper pinyon-juniper zone near Black Canyon Monument, Colorado. This was seeded 10 years ago and the crested wheatgrass has spread to adjacent areas.

The upper pinyon-juniper zone ranges from 7,000 to 8,000 feet elevation and has an annual precipitation of 13 to 18 inches. Reseeding possibilities in this zone are much better than in the lower zone (fig. 4). Typical of this zone are areas above Glade Park, Bayfield, and Mancos; much of Mesa Verde National Park; narrow belts on both sides of the Uncompahgre Plateau; and the Black Canyon area of the Gunnison. The upper edge of this zone often joins the mountain brush type, and contains scrub oak, serviceberry, and mountain mahogany. Trees are larger and pinyon pine more abundant. Range condition tends to be better at higher elevations, but is still generally poor. Grass is sparse except on ungrazed areas that are inaccessible or have been protected from grazing as in Mesa Verde National Park. Native plants common to the upper zone include muttongrass, sedges, prairie junegrass, Indian ricegrass, rock goldenrod, scarlet globemallow, trailing fleabane, and hairy goldaster. Blue grama is limited to the southern portion of the type and beardless wheatgrass to the northern portion.

WHERE TO RESEED

Before reseeding any area, consider the need for and the expected value from reseeding, and see if the benefits will make reseeding worth while. Lands with the following four characteristics make good reseeding possibilities. Reseed those areas first that meet not one, but all four of these qualifications.

1. Native forage is so sparse that proper grazing management could not be expected to improve the land within a reasonable period of time. Protection from grazing or improved management cannot restore plants that have completely disappeared. However, often what appears to be bare ground is just an area grazed so closely that good native grasses are overlooked. If almost all perennial forage plants are gone, reseeding is needed.

2. The land is good enough to insure successful reseeding. Reseed the better lands first is a good principle to follow. Greater yields will be obtained and information gained will help in judging the seeding possibilities and methods of seeding on the poorer lands. Look at the understory stands of low-value weeds and shrubs. Good vigor of these plants usually indicates fertile soil which will produce good stands of seeded species. Steep slopes and rocky areas usually should not be seeded until the better lands have been improved.

3. Forage or soil protection is needed at this site. Reseeded grass is most valuable in early spring at key locations. Livestock need and relish green herbage then, and reseeding to early growing grasses will supply this need and cut down the winter feeding period. Widespread reseeding on spring ranges also may allow livestock to remain longer in these areas and thus relieve too early grazing on summer ranges.

4. The seeded area can be protected and properly managed. Seedling stands need protection until they are well established and after establishment the areas should be utilized properly. Reseeding is not a "cure-all" and reseeded grasses will be damaged by too early and too heavy grazing just as were the original native grasses. The availability of stock water may greatly influence grazing management and thus be the deciding factor on whether to reseed.

Figure 3.--Poor site in lower zone 15 miles southwest of Delta. There is little vegetation under the trees; the soils are sandy with little organic matter, and often eroded. Experimental reseeding is being tried here but failures are common on such sites.

Figure 4.--A good reseeding site in the upper zone near Black Canyon. Big sagebrush in the understory usually indicates better soils, and more favorable growing conditions. Compare this area with the poor site shown in figure 3.

If an area qualifies as a good reseeding possibility by the above standards, and it is decided that reseeding is worth a trial, then here are the steps to consider:

1. How to overcome pinyon-juniper tree competition and prepare a seedbed.
2. Seed distribution and covering.
3. Which grasses are best.
4. Rates of seeding.
5. Dates of seeding.
6. How to graze seeded areas.

Suggestions on how to do each of these steps follow.

HOW TO RESEED PINYON JUNIPER LANDS

Pinyon-juniper lands are hard to seed. Dead or alive, the trees are a hindrance to machinery and to good seedbed preparation. Soils are usually low in organic matter and moisture-holding capacity. Erosion has removed much of the top soil over large areas and it is hard to get good stands of grass on the remaining raw soils when grasses have to compete with tree roots for moisture and nutrients. Bare ground under and adjacent to trees is common. It often indicates erosion of considerable top soil and intense competition with grass from the widespreading pinyon and juniper roots in the remaining poorer soils. In the lower pinyon-juniper zone, where the rainfall is less than in the upper zone, there is even less moisture to support both trees and grass. Examples of root competition are shown in figures 5 and 6.

The amount of root competition from these trees varies from tree to tree and from area to area. In general, the younger, more vigorous trees seem to be the most serious competitors with grass. In some areas such as Mesa Verde, the native grasses are observed growing right under the trees (fig. 7). At the Lytle Seed Farm near Montrose, there is a good stand of reseeded crested wheatgrass under the trees (fig. 8). Despite these exceptions, it is safe to assume that reseeding will be more profitable if all or most of the trees are removed before reseeding.

METHODS OF KILLING PINYON-JUNIPER TREES

Because of the root competition, a general rule is to kill the pinyon and juniper trees before reseeding. Many methods for eradication of pinyon and juniper trees have been tried. Most of them are expensive. A combination of two or more methods may often be more feasible than a single method of eradication. The advantages and limitations of some of the methods are as follows:

Singeing is the least expensive method, but can be done safely only when trees occur in sparse open stands. Extreme caution must be used with fire in the pinyon-juniper zone. Singeing can seldom be recommended if other valuable timber or brush types might be burned. Individual trees in open stands may be killed by singeing or scorching with a weed burner. Precautions to observe are:

1. If singeing is to be done on State or private land, notify the county sheriff when and where the singeing will be done. If on Federal lands, the District Forest Ranger or District Range Manager must authorize the project.

Figure 5.--A seedbed was prepared by plowing and crested wheatgrass and smooth brome were drilled here in April 1949. Trees were removed. By June 1, 1950, crested wheatgrass plants grew to be 6 to 8 inches tall and were forming seedheads.

Figure 6.--Where the trees were undisturbed and the seed drilled after plowing, there were only half as many crested wheatgrass plants and they were only 3 inches tall. (Crested wheatgrass is left of axe).

2. Construct an adequate fire guard strip around the entire block containing all trees to be singed. The strip must be at least 50 feet wide, cleared of all vegetation and litter down to mineral soil with an additional 200 feet burned-out backfire strip. This is especially important where there is an understory of sagebrush, or other native grasses, weeds. or shrubs that would carry a fire.

3. Singe each individual tree with a weed burner. The needles will scorch and burn very quickly. Wait until each tree is thoroughly scorched before singeing the next tree. Start at the outside perimeter (inside the fire guard strip) and work toward the center of the block.

4. Singe only in late summer or early fall when days are hot and trees will burn, otherwise the scorching will be patchy and the trees will continue to grow.

5. Singe only on a calm day with little or no wind.

6. Have a stand-by crew.

7. Keep the fire within bounds, or be prepared for damages and lawsuits.

8. Avoid singeing trees on steep slopes where reseeding is difficult and where soils might erode before grasses could become established.

Wheatland or Brushland plowing is feasible only where the trees are small. This method is often used where small trees are invading sagebrush areas.

Cutting and girdling are expensive and are feasible only when trees are sparse, or when it is possible to utilize the trees for wood or posts. Often after the best trees are cut, the remaining stand can be girdled or scorched to clear the area for reseeding.

Seedling establishment will be difficult where the soils are sandy, have low moisture-holding capacity, and where the rate of evaporation is high. Therefore, if limbs left from cutting can be scattered over the area they provide a partial mulch and make conditions more favorable for survival and growth of grass seedlings.

Poisoning with sodium arsenite is effective and reasonable in cost where there are less than 100 trees per acre. This solution is poisonous and must be used with extreme caution. Steps in its use as recommended by the Southwestern Forest and Range Experiment Station are as follows:

1. Obtain stock solution of sodium arsenite of 8 pounds to the gallon from a chemical supply house and mix 1 part of this stock solution with 2 parts of water.

2. Girdle or frill the trees near the base with downward cuts of the axe to form a crevice around the tree which will hold the poison and prevent animals from reaching it.

3. Apply the solution with a quart-size engineer's oil can with pump attachment to moisten the cut portions of the wood (1 gallon should treat about 240 trees).

Figure 7.--Good stands of grass under pinyon-juniper trees are rarely seen, and probably indicate above-average conditions. A good stand of native grasses does occur under trees at Mesa Verde.

Figure 8.--Crested wheatgrass grows under the trees near Black Canyon. Both areas (figures 7 and 8) are located in the upper pinyon-juniper zone.

4. An alternate method, best used on trees with low hanging limbs, is to dig a small basin in the soil at the base of the tree and pour a pint of solution (1 part stock solution to 7 parts water) into this basin. This method takes more chemical but less labor. The basin should be covered with brush or dirt after treatment to prevent access of animals to the dried-up solution.

5. Arsenic is poisonous to humans and animals, and care must be used in mixing and treatment. Keep all equipment and materials out of reach of children and animals.

6. Chemicals spilled on soil or vegetation should be covered with soil or brush.

7. Arsenic is absorbed through the skin; therefore, wear heavy gauntlet gloves which have been dipped in hot paraffin, change clothes daily, and avoid all skin contact with the solution.

For further information on control of juniper in the southwest see "Juniper comes to the Grasslands" by Kenneth W. Parker, American Cattle Producer, November 1945, pages 12-14, 30-32.

Spraying with 2,4-D or 2,4,5-T has not been successful, although further research may show this to be one of the better methods of control.

SEEDBED PREPARATION

Prepare a good seedbed. Eliminate understory weed and brush competition. Seeding in shrubs and weeds without seedbed preparation is almost certain to result in failure. A big sagebrush understory or sagebrush parks usually indicate lands that can be successfully reseeded; but before seeding, the sagebrush must be killed. The methods recommended for control of sagebrush in "Reseeding Sagebrush Lands in Colorado," Bulletin No. 413-A by the Colorado Experiment Station can be readily applied to sagebrush parks in the pinyon-juniper. When sagebrush occurs under or between pinyon-juniper trees the procedure for controlling sagebrush follows the same principles, but because of trees, machinery is much more difficult to operate. A brief summary of methods of sagebrush control follows:

1. Eradicate sagebrush only in summer or early fall. Late fall operations when sagebrush seed is ripe may plant another crop of sagebrush.

2. Burning is an inexpensive and effective method of removing sagebrush, but cannot be recommended in pinyon-juniper areas because of the great danger of fire getting out of control.

3. Wheatland type plows are successful if care is used in operation and if they are not used on rough rocky areas. These plows kill 60 to 90 percent of the sagebrush and prepare a good seedbed. Plow when sagebrush is dry and brittle for maximum kills.

4. The Brushland plow as developed by the U. S. Forest Service clogs less, breaks less than the Wheatland type plow. It also prepares a good seedbed and eradicates 85 to 95 percent of the sagebrush.

5. Heavy offset disks prepare a good seedbed in small brush. They are less effective in large brush and require more power to operate.

6. Disk and moldboard plows are expensive to operate and their use is usually limited to productive non-rocky land. Because of their maneuverability, howeve they can often be used quite effectively among pinyon-juniper trees.

7. Railing is cheap but is not successful on flexible brush.

8. Pipe harrows are good on rough rocky lands. They eradicate 50 to 60 percen of small brittle sagebrush.

9. Recently there has been considerable interest in brush cutters. These have not been thoroughly tested but observations indicate that undercutters might be useful in seedbed preparation on rock-free areas. The above-ground cutters kill most of the sagebrush but do not prepare a seedbed.

10. Spraying with 2,4-D and related chemicals offers promise but more research is needed before definite recommendations can be made for killing big sagebrush.

A well-prepared seedbed permits seeding at a uniform rate and depth. A firm seedbed holds the moisture for seed germination better than a loose seedbed. A firm seedbed is a necessity for spring seeding since the ground will have little chance to settle before germination begins. With fall seeding this is not so important because fall and winter storms will usually settle a loose seedbed before germination. There is always danger of burying the seed too deeply when seeding on a loose seedbed.

SEED DISTRIBUTION AND COVERING

Drilling is the best method of distributing seed evenly and covering it uniformly. Do not cover most grass seeds deeper than 1 inch, as it reduces emergence. Cover the small to medium-sized seed of crested wheatgrass and most species used in range reseeding about one-half inch deep. Cover small-seeded species such as bluegrasses one-fourth inch deep. Larger seeds may be covered up to 1 inch deep. Plant shallow on heavy clay soils to reduce losses from crusting and plant deeper on sandy soils to avoid losses from rapid drying.

Where drilling is not feasible, broadcast the seed with machine or hand-driven broadcasters and cover by shallow Wheatland plowing, disking, pipe harrowing, or brush dragging. If seed distribution is poor and covering uneven, which often happens in broadcasting, increase the rate of seeding one-half over drilled seed. On rough freshly worked areas, soil sloughing is sometimes sufficient to cover broadcast seed, but in general some type of dragging or disking should be done to assure seed covering.

Airplane seeding must be regarded as just a method of rapid broadcasting. It is satisfactory only when the broadcast seed is covered by leaf fall, soil sloughing, disking, or some other method. Airplane seeding of seed compressed in pellets of soil has been given much publicity. All experimental pellet seedings with which we are familiar show that pellet seeding is unsatisfactory, and broadcasting plain seed is better than

broadcasting pelletized seed. In comparative tests on 8,000 acres of national forest land in southeastern Utah, first-year results showed that unpelleted seed produced 15 to 165 times more grass plants than pelleted seed after airplane broadcasting. Pelleting seriously reduced seed germination and field emergence.4/

WHAT TO SEED

SPECIES

Crested wheatgrass5/ is the most widely used and generally adapted species for reseeding in pinyon-juniper type, and is the only proven species for the lower pinyon-juniper zone. Other grasses which might be tried in this zone are shown in table 1. Methods and seasons of seeding to obtain good stands have not yet been well tested in this lower zone. Therefore, proceed slowly in seeding these dry sites at low elevations.

For the upper pinyon-juniper zone, the following four wheatgrasses are good: crested, pubescent, intermediate, and tall wheatgrasses. Yellow blossom sweetclover is an easily established and drought-tolerant legume that can be used with grass mixtures. This or some other adapted legume should be seeded wherever possible. Other species which can be tried are shown in table 1.

Over 200 forage plants are being tested in row plots on a sagebrush opening in the upper pinyon-juniper zone south of Crawford. Many seed sources and strains are also being tested. Some of the better species have been seeded in range plots in both pinyon-juniper zones (fig. 9).

Different methods and seasons of seeding have been used in these trial seedings. The Soil Conservation Service and Bureau of Land Management have made numerous observational and some large-scale seedings. Ranchers and farmers have made experimental plantings in several areas in the pinyon-juniper type (fig. 10).

RATE OF SEEDING

Recommended rates of seeding are given in table 1 for planting each species individually. These are average seeding rates for drilling good seed on a good seedbed. Four factors determine the correct amount of seed to sow:

1. efficiency of method of seeding.
2. Type of seedbed.
3. Size of seed.
4. Purity and germination of seed.

Where seed is broadcast or the seedbed is poor, increase rates of seeding 50 percent over those shown in the tables. Plenty of seed helps get full stands quickly and keeps down invasion of weeds and brush. Too much seed increases seeding costs and does not give correspondingly higher yields.

4/ Bleak, A. T. and Phillips, T. A. "Seeding stands from airplane broadcasting of pelleted and unpelleted seed in southeastern Utah." Research Paper No. 22. Intermountain Forest and Range Experiment Station. Aug. 1950.

5/ For scientific names of species recommended for reseeding, see table 1.

Figure 9.--Intermediate wheatgrass (Agropyron intermedium) in a range plot near Crawford in May 1950. Seed was drilled in April 1949, after trees were removed and sagebrush was disked.

Figure 10.--Dryland grass nursery in the pinyon-juniper type at the Lytle Seed Farm near Montrose. Starting in 1939 over 50 species were seeded to see which were best adapted for this area. Note how the two rows of stiffleaf wheatgrass which were spaced 4 feet apart have formed an almost solid sod.

Table 1.--Recommended and promising species for reseeding in the pinyon-juniper zone in western Colorado

Common name	Scientific name	Pounds of seed per acre 1/
	Lower zone	
Recommended species		
Crested wheatgrass	Agropyron cristatum	5
Promising species which may be tried		
Desert wheatgrass	Agropyron desertorum	5
Beardless wheatgrass	Agropyron inerme	7
Intermediate wheatgrass	Agropyron intermedium	7
Siberian wheatgrass	Agropyron sibiricum	5
Bluebunch wheatgrass	Agropyron spicatum	7
Pubescent wheatgrass	Agropyron trichophorum	7
Russian wild-rye	Elymus junceus	6
Indian ricegrass	Oryzopsis hymenoides	8
	Upper zone	
Recommended species		
Crested wheatgrass	Agropyron cristatum	6
Tall wheatgrass	Agropyron elongatum	8
Intermediate wheatgrass	Agropyron intermedium	8
Pubescent wheatgrass	Agropyron trichophorum	8
Yellow blossom sweetclover	Melilotus officinalis	1 - 2
Promising species which may be tried		
Amur wheatgrass	Agropyron amurense	8
Desert wheatgrass	Agropyron desertorum	6
Beardless wheatgrass	Agropyron inerme	8
Stiffleaf wheatgrass	Agropyron pungens	10
Siberian wheatgrass	Agropyron sibiricum	6
Western wheatgrass	Agropyron smithii	12
Bluebunch wheatgrass	Agropyron spicatum	8
Slender wheatgrass	Agropyron trachycaulum	7
Tall oatgrass	Arrhenatherum elatius	8
Meadow brome	Bromus erectus	8
Smooth brome	Bromus inermis	8
Russian wild-rye	Elymus junceus	7
Sheep fescue	Festuca ovina	6
Indian ricegrass	Oryzopsis hymenoides	10
Big bluegrass	Poa ampla	4

1/ Amounts are based on drilling good seed in a good seedbed. Increase seed 50 percent when broadcasting. Also increase when seed is of poor quality.

ROW SPACING

Consider these four factors in determining row spacing:

1. Forage production.
2. Soil protection.
3. Invasion of brush and weeds.
4. Seed production.

Most range reseeding is to attain maximum forage production and soil protection with a minimum invasion of brush and weeds. Many tests with crested wheatgrass in the sagebrush type indicate that close row spacings of 6 inches provide as much or more forage, provide more soil protection, and are more effective in keeping weeds and brush from invading than wider spacings. Close row spacings of 6 to 8 inches are therefore recommended for practically all range reseeding. Row spacings of 24 to 48 inches yield more seed than close spacings and are recommended for raising seed to harvest.

GOOD SEED

It takes good seed to grow a good crop. In buying seed be sure the percent purity and germination is high. Most seed houses show the germination and purity on the tag. Sometimes seed is bought locally or is old and there is a question as to germination and purity. In such cases, mix well and take a small amount of seed from each sack, then send about one-fourth pound of seed to the State Seed Laboratory, Colorado A & M College, Fort Collins. Indicate whether standard or farmer germination and purity tests are desired. The State Laboratory will make the standard germination test for $0.50 to $1.00. Purity tests, which also show noxious weed seed content, cost $1.00 to $2.50. The farmers' test costs about half as much as the standard and gives approximate germination, purity, and content of noxious weed seed.

WHEN TO SEED

In the lower pinyon-juniper zone (6,000 to 7,000 feet elevation) the rainfall is low (10 to 13 inches annually) and erratic. Seeding at any season is hazardous. In general, very early spring and late fall seedings are most promising. Late fall seeding (October and November) allows seed to germinate the next spring. Plant seed in early March on seedbeds that have been prepared the previous summer or fall and winter fallowed. Spring seedings made after early March decrease the chances of success.

The upper pinyon-juniper zone (7,000 to 8,000 feet elevation) has somewhat the same precipitation pattern as the lower lands. The annual precipitation of 13 to 18 inches is more dependable than on the lower lands. Fall seedings made from the last of September through November are recommended. Although seedings can be made with some assurance in early March on well-prepared seedbeds, muddy roads and soft soils usually prevent spring seeding till late in April or May. When seeded this late, seedlings often cannot become well enough established to withstand the summer drought.

HOW TO GRAZE RESEEDED AREAS

Do not begin grazing newly seeded areas until the plants are well enough established to prevent plants being pulled up by grazing animals. Firm establishment is usually reached during the summer or fall of the second or third growing season. Early or heavy grazing may either destroy a stand or reduce plants in vigor so that they are slower to reach a full stand. Do not permit livestock to use reseeded areas in the spring until soils are dry enough to prevent cutting and compacting by the animal's hoofs.

After the plants are well established, graze the reseeded area moderately to leave enough of the plant to maintain plant vigor and protect the soil.

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NATIVE PLANTS

Scientific name	Common name
Grasses	
Agropyron inerme	Beardless wheatgrass
Agropyron smithii	Western wheatgrass
Aristida fendleriana	Fendler three-awn
Bouteloua gracilis	Blue grama
Bromus tectorum	Cheatgrass
Carex spp.	Sedges
Elymus ambiguus	Colorado wild-rye
Hilaria jamesii	Galleta
Koeleria cristata	Prairie junegrass
Oryzopsis hymenoides	Indian ricegrass
Poa fendleriana	Muttongrass
Weeds	
Chrysopsis villosa	Hairy goldaster
Erigeron flagellaris	Trailing fleabane
Opuntia spp.	Prickly pear
Phlox longifolia	Phlox
Salsola kali tenuifolia	Russian thistle
Sisymbrium altissimum	Tumbling mustard
Solidago petradoria	Rock goldenrod
Sphaeralcea coccinea	Scarlet globemallow
Trees and Shrubs	
Amelanchier oreophila	Serviceberry
Artemisia tridentata	Big sagebrush
Atriplex confertifolia	Shadscale
Cercocarpus montanus	Mountain mahogany
Gutierrezia sarothrae	Broom snakeweed
Purshia tridentata	Bitterbrush
Quercus gambeli	Scrub oak or gambel oak
Juniperus monosperma	Single-seeded juniper
Juniperus scopulorum	Rocky Mountain juniper
Juniperus utahensis	Utah juniper
Pinus edulis	Pinyon pine